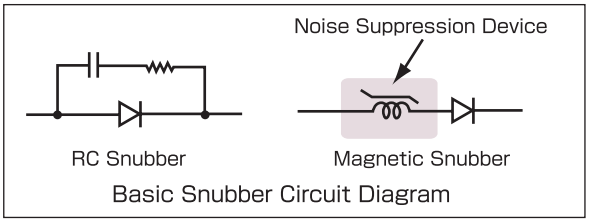
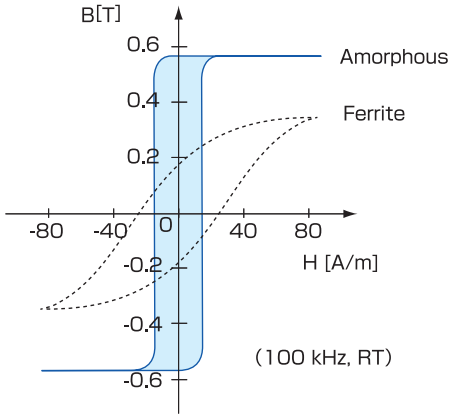
2. Noise Suppression Devices

An amorphous noise suppression device is unique and completely different from conventional noise filters. Conventional noise prevention products focus on somehow minimizing the noise after it's been created, by typically trying to absorb the noise, and so their effectiveness in noise reduction is directly influenced by frequency of the circuit. Amorphous noise suppressing devices, on the other hand, focus on the source of the noise and work to prevent or minimize the noise before it has a chance to develop. The source of the electronic circuit noise is the rapid change of current or voltage, and the effectiveness of the amorphous cores in eliminating this noise is independent of frequency.

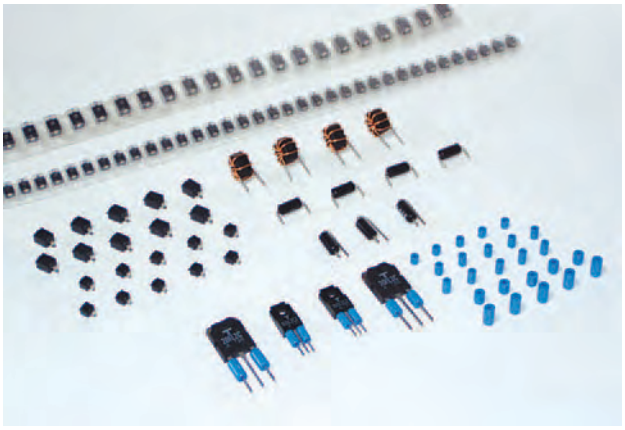
An amorphous noise suppression device is a product that takes full advantage of the unique magnetic characteristics of the cobalt based amorphous alloy. Toshiba Materials offers two noise suppression devices, "AMOBEADS®" and "SPIKE KILLERS®". AMOBEADS®" deliver excellent noise suppression results and are convenient to use by simply being slipped over the leads of the semiconductor device. "AMOBEADS®" are also available with a lead thru and in a surface mount configuration. "SPIKE KILLERS®", which are larger in size than "AMOBEADS®", most often are wire wound and are effective in eliminating or minimizing higher noise levels.



Basic Snubber Circuit Diagram

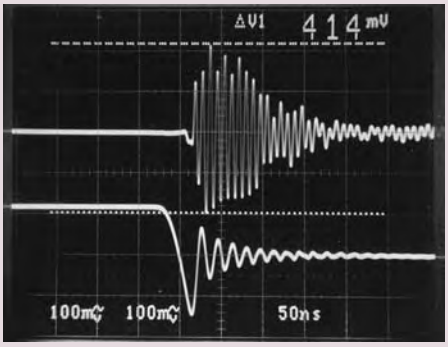


B-H Curve (typical)


Noise Suppression Devices

Example for Noise Suppressing Effect (Chopper Converter)

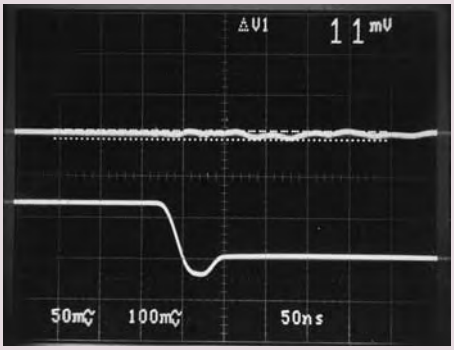
With an excellent saturable characteristic, "AMOBEADS ® suppress the reverse recovery current of the diode and decrease the noise that was occurring. When the current for diode reverses and tries to go into the recovery condition, the "AMOBEADS®" displays a large inductance and oppose the generation of the recovery current. In this instance, a soft recovery is possible for core material with a smaller coercive force.



Without Countermeasure

Output Noise

Diode Current
1 A/div



With AMOBEADS®
(AB4×2×8W)

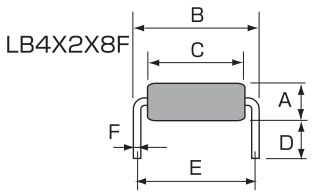
Standard Specifications

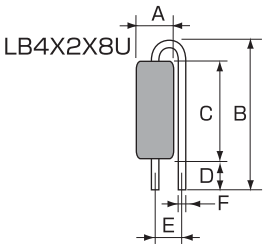
AMOBEADS®

Type No.	Finished Dimensions [mm]			Core Size [mm]*1			Total Flux*2	AL value*3	Insulating Cover *7	Packing Unit
	O.D. max	I. D. min	H.T. max	O.D.	I. D.	H.T.	φc[μWb] min	L[μH] min		
AB3X2X3W	4.0	1.5	4.5	3.0	2.0	3.0	0.9	3.0	PBT case Blue	2,000 [pcs/box]
AB3X2X4.5W	4.0	1.5	6.0	3.0	2.0	4.5	1.3	5.0		
AB3X2X6W	4.0	1.5	7.5	3.0	2.0	6.0	1.8	7.0		
AB4X2X4.5W	5.0	1.5	6.0	4.0	2.0	4.5	2.7	9.0		
AB4X2X6W	5.0	1.5	7.5	4.0	2.0	6.0	3.6	12.0		
AB4X2X8W	5.0	1.5	9.5	4.0	2.0	8.0	4.8	16.0		

AMOBEADS®with lead

Type No.	Finished Dimensions [mm]						Core Size [mm]*1			Io *4 [A]	Total Flux *2 φc[μWb]	AL value *3 L[μH]	Insulating Cover *7	Packing Unit
	A	B	C	D	E	F	O.D.	I.D.	H.T					
LB4X2X8F	6.0max	16.0max	12.0max	4.2±0.5	14.0±1.0	φ1.25±0.1	4.0	2.0	8.0	8.0	4.8 min	16.0 min	PBT case Black	1,000 [pcs/box]
LB4X2X8U	6.0max	20.0max	12.0max	4.0±0.5	5.0±1.0	φ1.25±0.1								

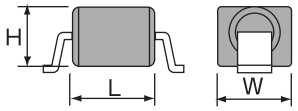


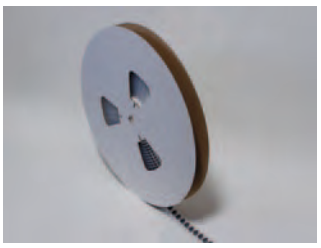


AMOBEADS®

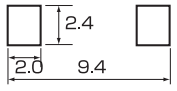
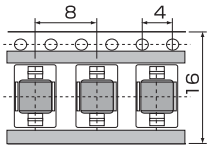
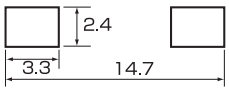
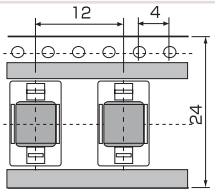
SMD Type AMOBEADS®

Type No.	Finished Dimensions [mm]			Lead	Core Size [mm] *1			Io *4 [A]	Total Flux *2 φc[μWb]	AL value *3 L[μH]	Insulating Cover *7	Packing Unit [pcs/reel]
	width	length	height	width x thickness	O.D.	I.D.	H.T					
AB3X2X3SM	5.0±0.3	5.0±0.3	4.0±0.3	(1.8×0.35)	3.0	2.0	3.0	6.0	0.9 min	3.0	LCP case Black	2,000
AB4X2X6SM	6.0±0.3	8.0±0.3	5.0±0.3	(1.8×0.52)	4.0	2.0	6.0	9.0	3.6 min	12.0		1,000





Paper Reel（330φ）

	Recommended Land Pattern (mm)	Taping Spec.(mm)
AB3X2X3SM		
AB4X2X6SM		

SPIKE KILLER®

Type No.	Finished Dimensions *6 [mm]			Core Size [mm] *1			Effective core cross section *1 Ae[mm²]	Mean Flux Path Length *1 Lm [mm]	Total Flux *5 φc[μWb]min	Coercive Force *5 Hc[A/m]	Rectangular Ratio *5 Br/Bm[%]	Insulating Cover *7
	O.D.	I.D.	H.T	O.D.	I.D.	H.T						
SS10X7X4.5W	11.5	5.8	6.6	10.0	7.0	4.5	5.06	26.7	4.73	22max	90min	PET case Black
SS14X8X4.5W	15.8	6.8	6.6	14.0	8.0	4.5	10.1	34.6	9.46			

*1 Reference Value *2 Minimum Guarantee on Measuring Condition : 50kHz、80A/m(sine wave), R.T.
*3 Measuring Condition : 50kHz, 1V, 1turn, R.T.
*4 Typical Value, using a cross section of lead
*5 Measuring Condition : 100kHz, 80A/m (sine wave), R.T. *6 Tolerance ±0.2 [mm]
*7 UL94V-0 approved material

☆"AMOBEADS® " sample kits are prepared. Please ask to sales department.
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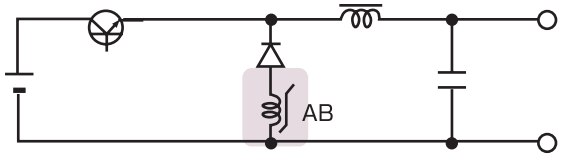
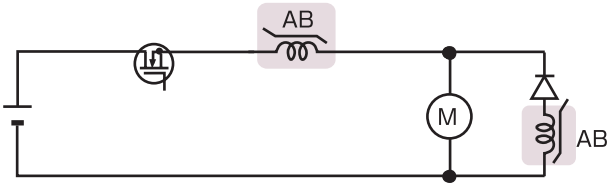
☆"AMOBEADS® " and "SPIKE KILLER ® " : Resistered in U.S.A., France, Germany, U.K., Japan.

Examples of Applied Circuits and their Characteristics

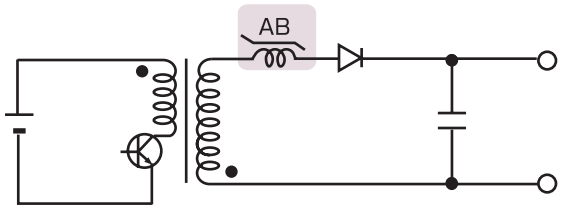
Application of Amorphous Noise Suppression Devices



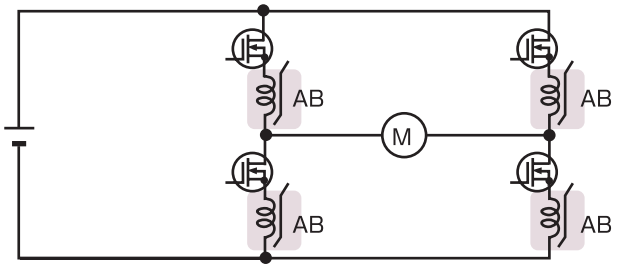
Chopper Converter



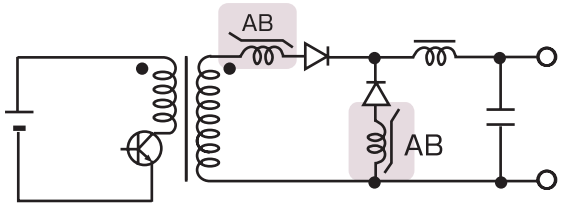
Control Circuit for Motor



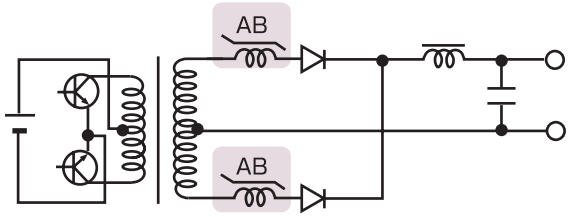
Flyback Converter



Motor Driving Circuit

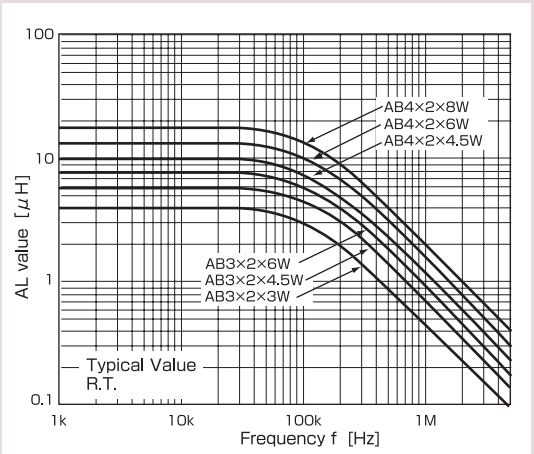


Forward Converter

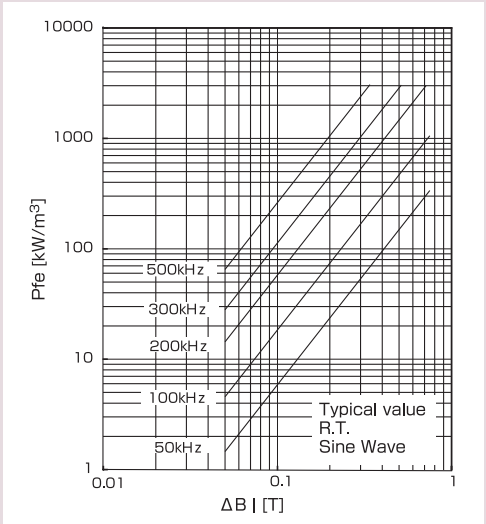


Push-pull Converter

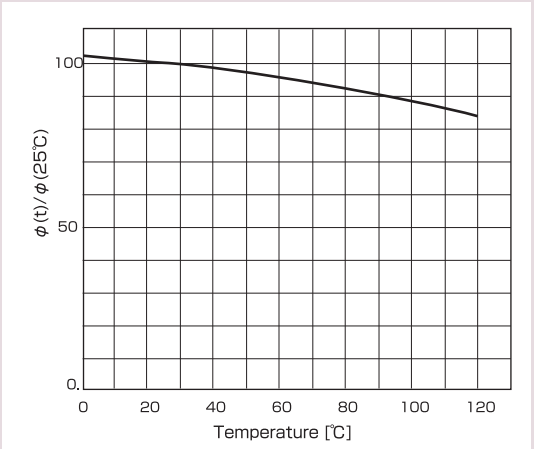
Characteristics (Typical value)



Frequency Characteristics of Inductance



Coreloss Characteristic [AMOBEADS®]



Flux(φ) Decline Ratio vs. Temperature

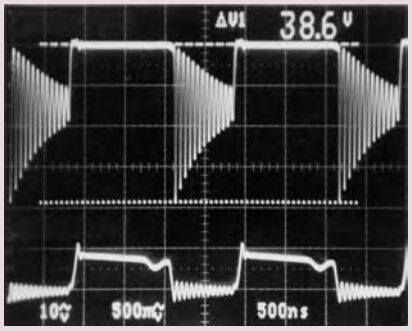
Effects of Noise Suppression by AMOBEADS®

Spike Voltage Suppression

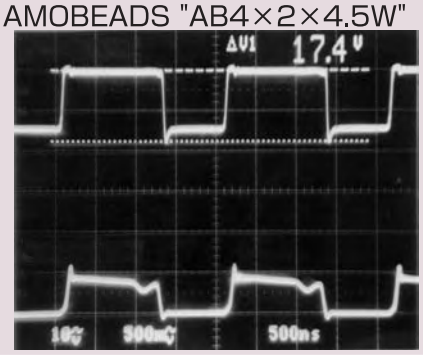
Spike voltage can be reduced and ringing phenomena can also be prevented by AMOBEADS, and also Schottky barrier diode (SBD) can be protected from over withstand voltage.

Frequency : 500kHz
Output Voltage - Current
: 5V-20A

Without Countermeasure



AMOBEADS "AB4×2×4.5W"



Diode Voltage
V_D
10V/div

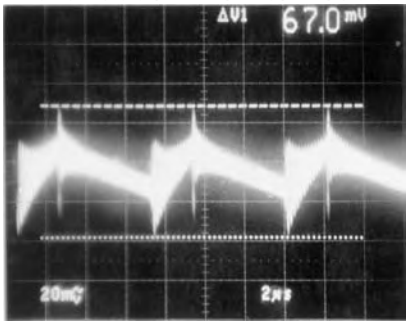
Diode Current
I_D
5A/div

Output Noise Reduction

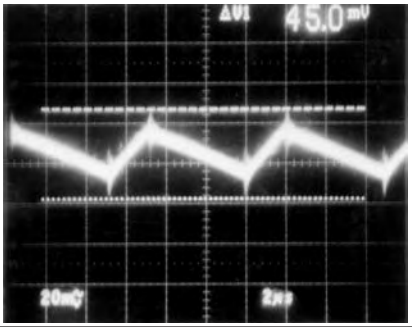
When the ferrite replaced to AMOBEADS at the secondary output diode (FRD) of the forward converter circuit, the output noise can be tremendously reduced, not only noise peak level but also amplitude range.

Frequency : 150kHz
Output Voltage - Current
: 15V-10A

RC Snubber +Ferrite Beads



AMOBEADS "AB4×2×4.5W"



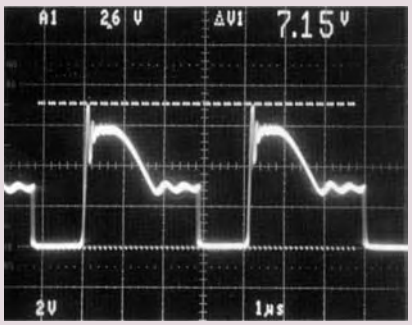
Output Noise
V_N
20mv/div

Primary Surge Voltage

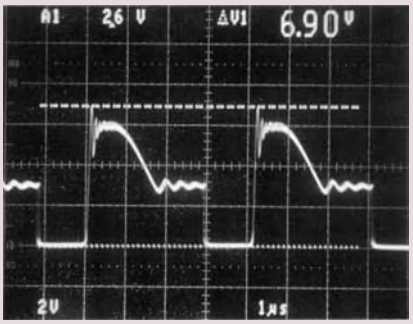
When the ferrite replaced to AMOBEADS at the secondary output diode (SBD) of the forward converter circuit, the output noise and harmful influence to the primary stage can be reduced. These effects are based on the inclination of the actual BH curves between amorphous and ferrite materials.

Frequency : 250kHz
Output Voltage - Current
: 5V-15A

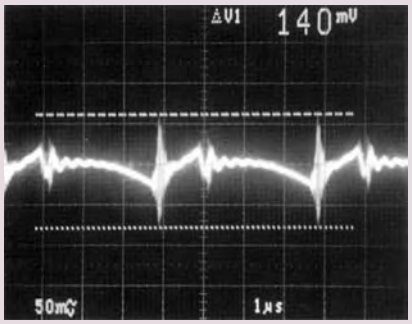
Ferrite Beads 4×2×4

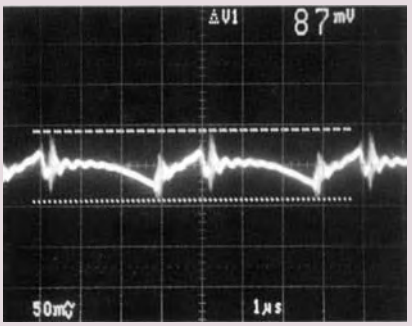


AMOBEADS "AB4×2×4.5W"



MOS-FET
Drain-Source
Voltage
V_{DS}
200V/div

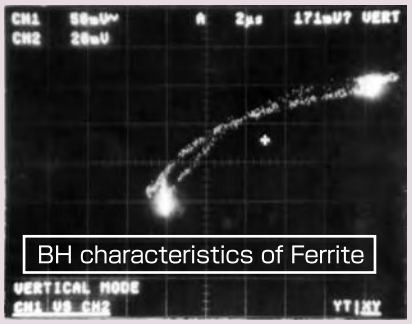




Output Noise
V_N
50mv/div

Output Noise

Actual BH Curve



B
H